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**James et al.**

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(54) **HIGH-SECURITY ENCLOSURE**

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**Related U.S. Application Data**

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(51) **Int. Cl.**
***E05G 1/04*** (2006.01)

(52) **U.S. Cl.**
USPC ..... **109/59 R**; 109/58.5; 109/74; 70/63; 70/86; 70/118

(58) **Field of Classification Search**
USPC ..... 70/102–104, 113, 118–120, 130, 70/131, 158–161, 63, 85, 86; 109/59 R, 45, 109/58.5, 74, 77
See application file for complete search history.

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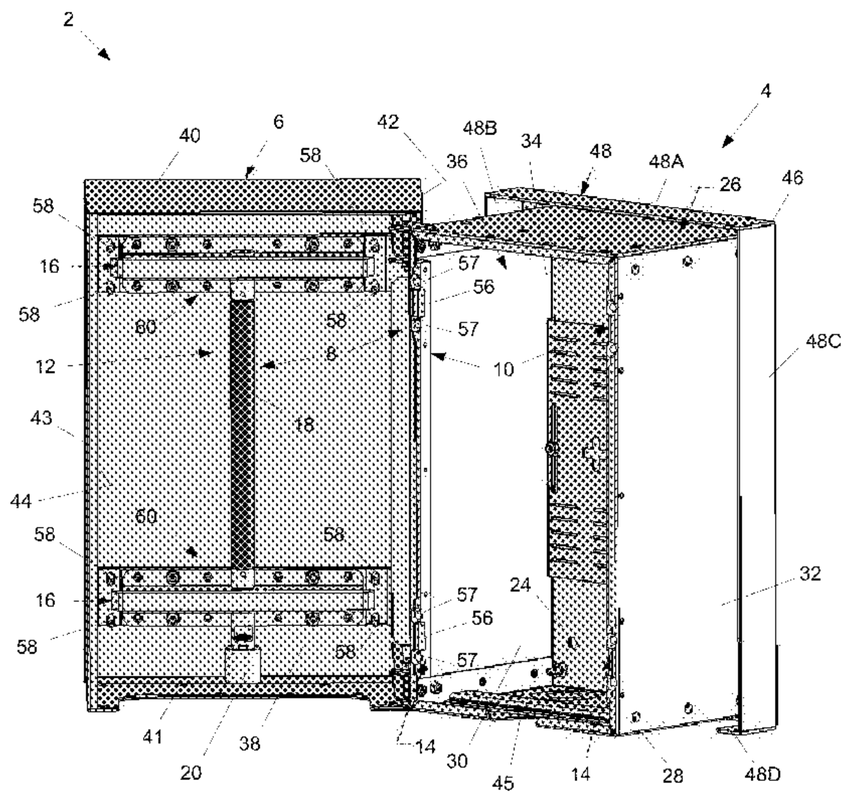
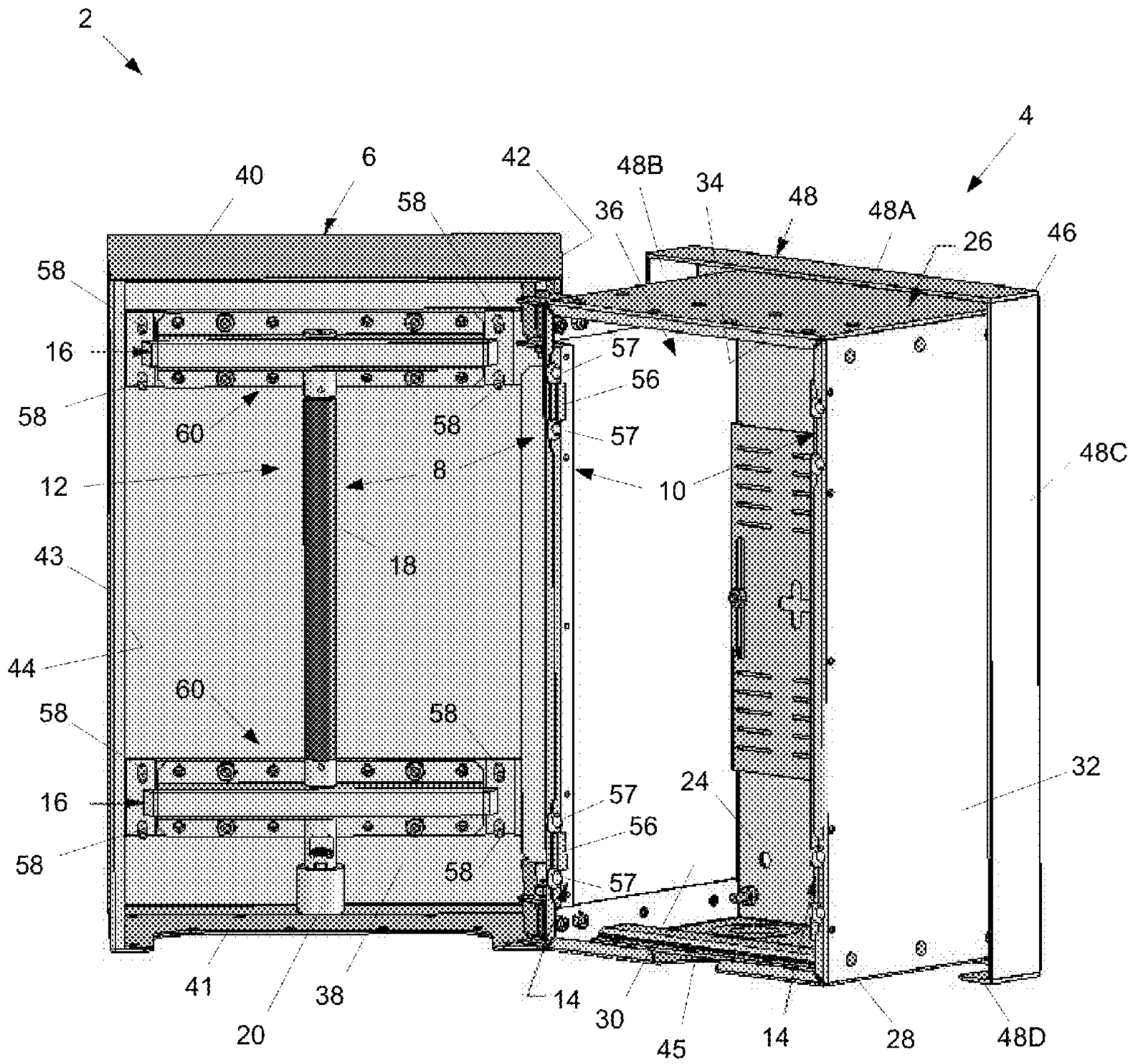
(57) **ABSTRACT**

A high-security enclosure includes a base, a cover and a lock system. The lock system includes a base portion and a cover portion. The lock system base portion includes one or more fixed lock bars. The lock system cover portion includes one or more movable lock bars. Each movable lock bar is generally perpendicular to, and arranged to engage, one of the fixed lock bars. The lock system cover portion further includes a lock bar retraction assembly coupled to the one or more movable lock bars for retracting the movable lock bar(s) substantially simultaneously out of engagement with the fixed lock bar(s). A security drive mechanism is coupled to the lock bar retraction assembly to drive the lock system.

**25 Claims, 12 Drawing Sheets**

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48C
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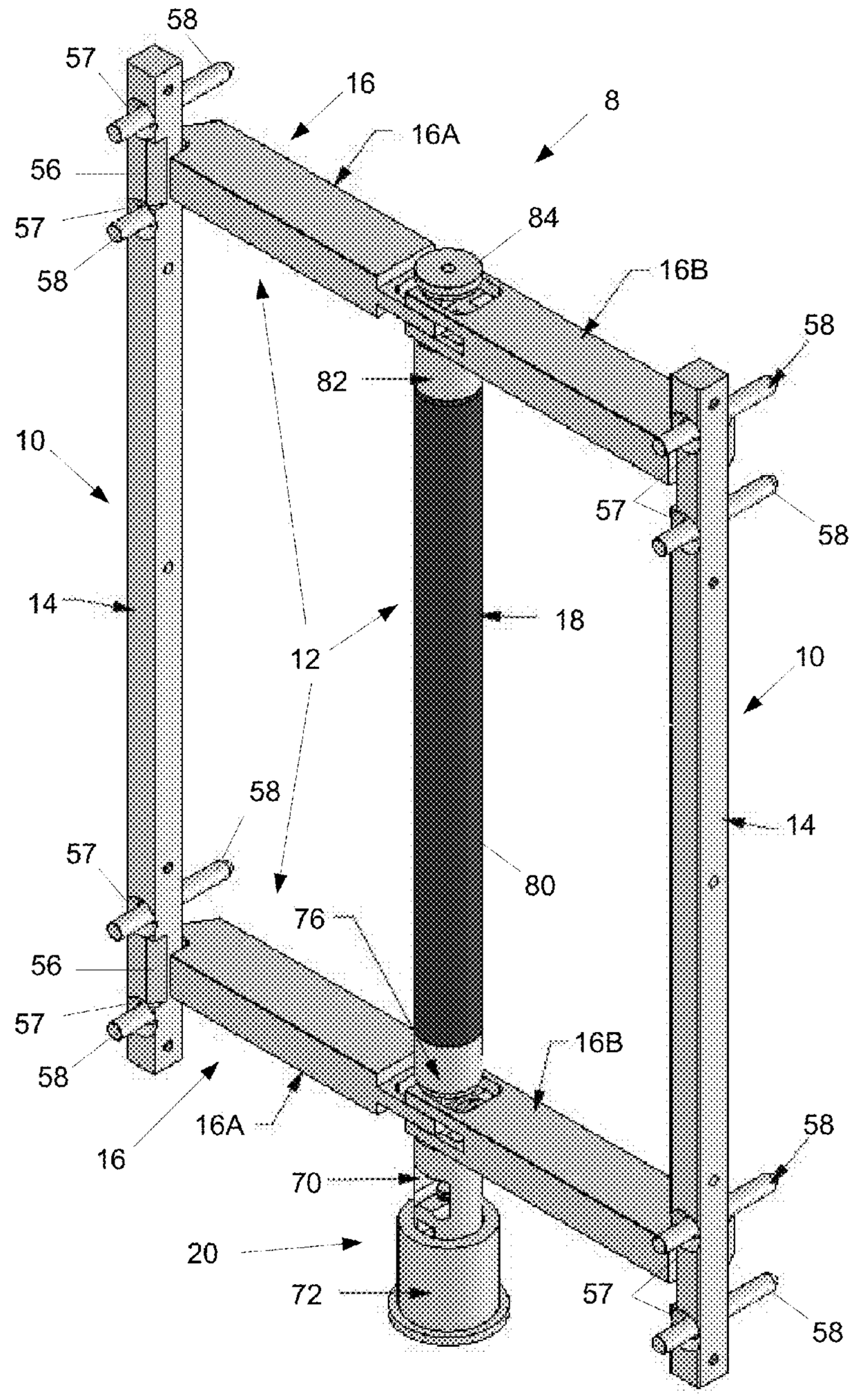
48D

FIG. 1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16B
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16B
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16A
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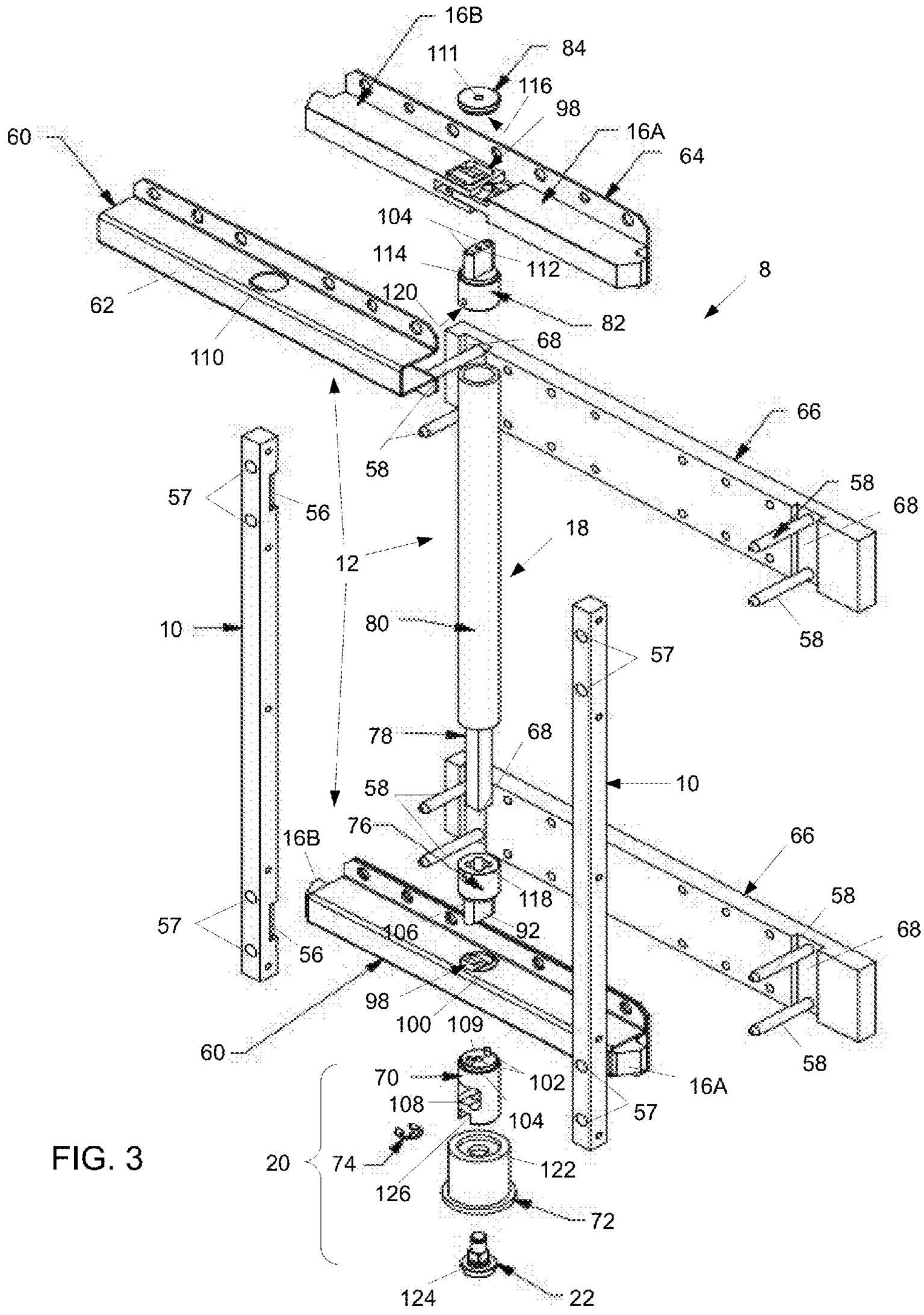
FIG. 2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57
56
18
12
10
80
58
57
78
68
10
58
76
16B
66
118
58
57
106
92
68
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16A
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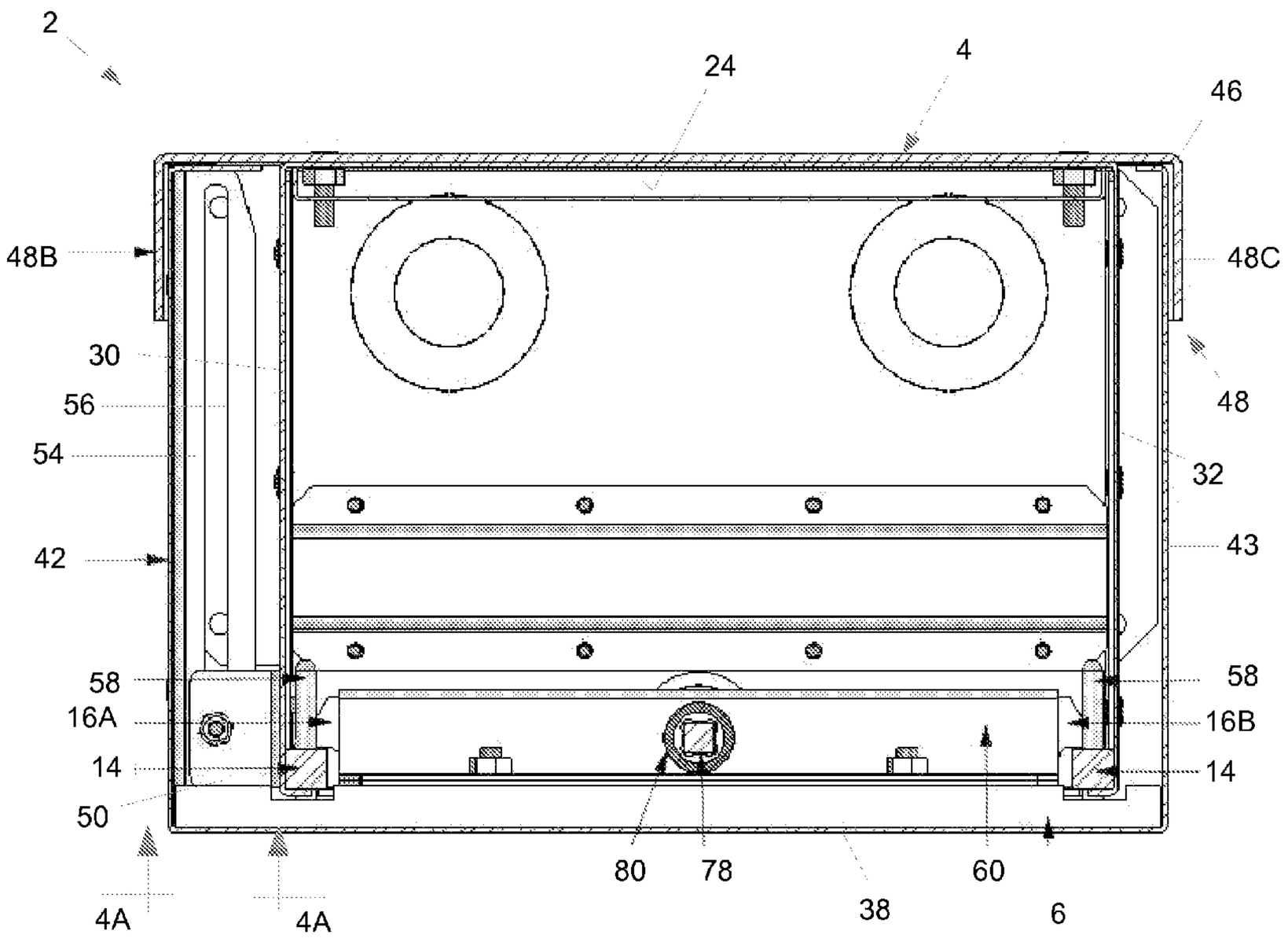
FIG. 3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48B
48C
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16B
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78
60
38
6
4A
4A

FIG. 4

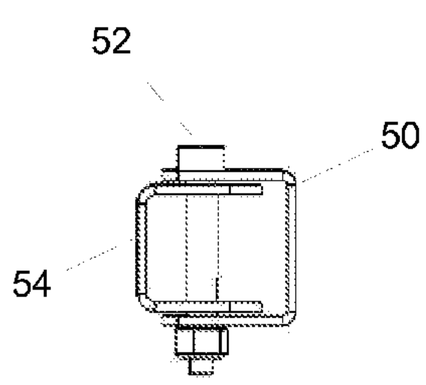
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FIG. 4A

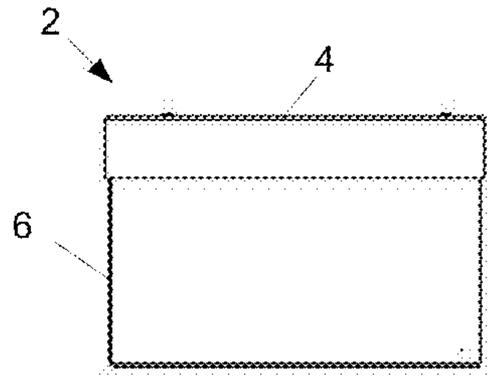



FIG. 5A

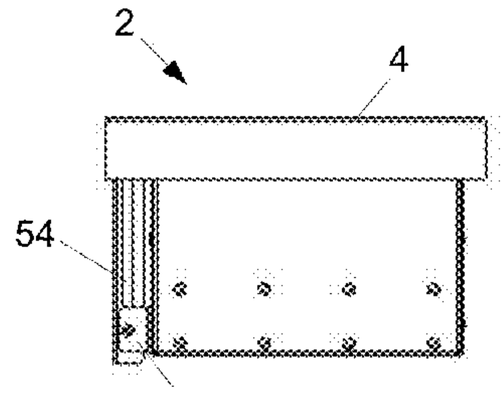



FIG. 5B

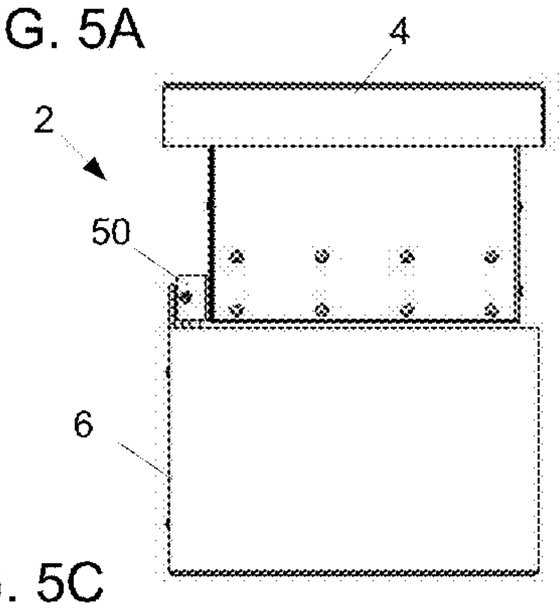



FIG. 5C

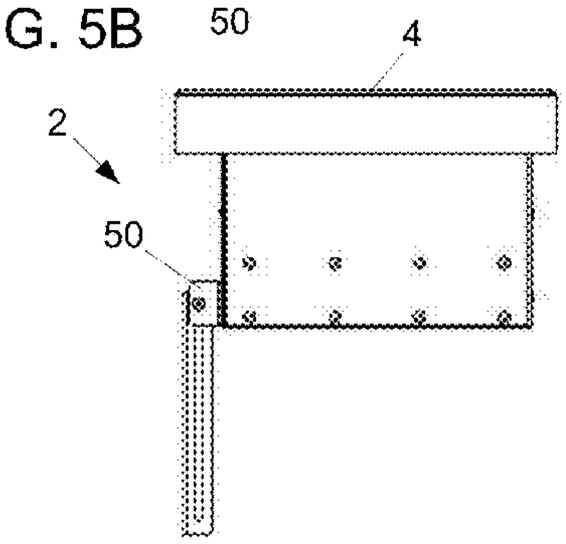



FIG. 5D

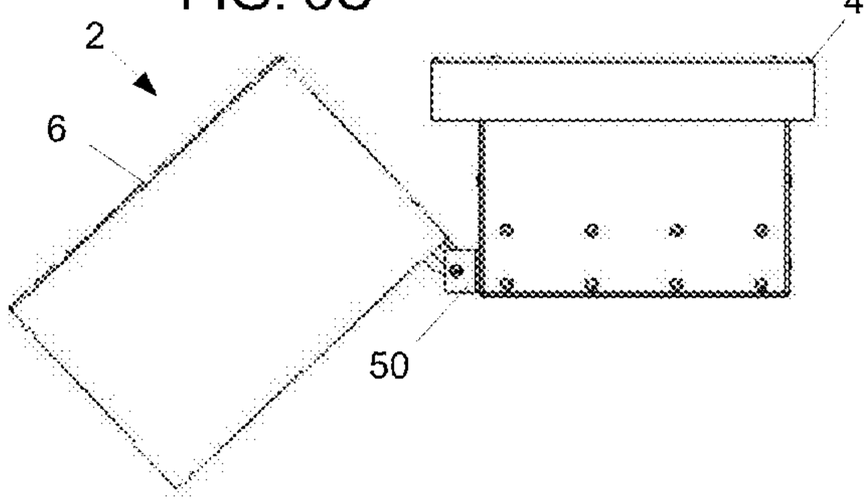



FIG. 5E

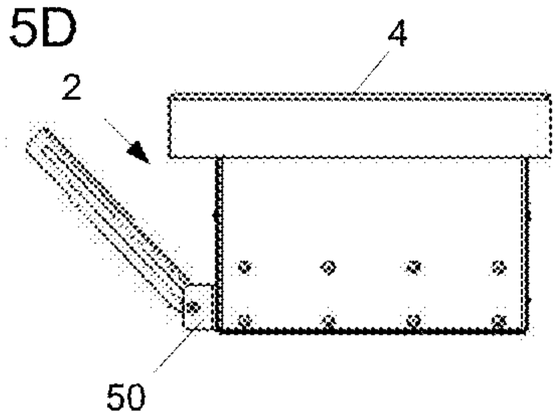



FIG. 5F

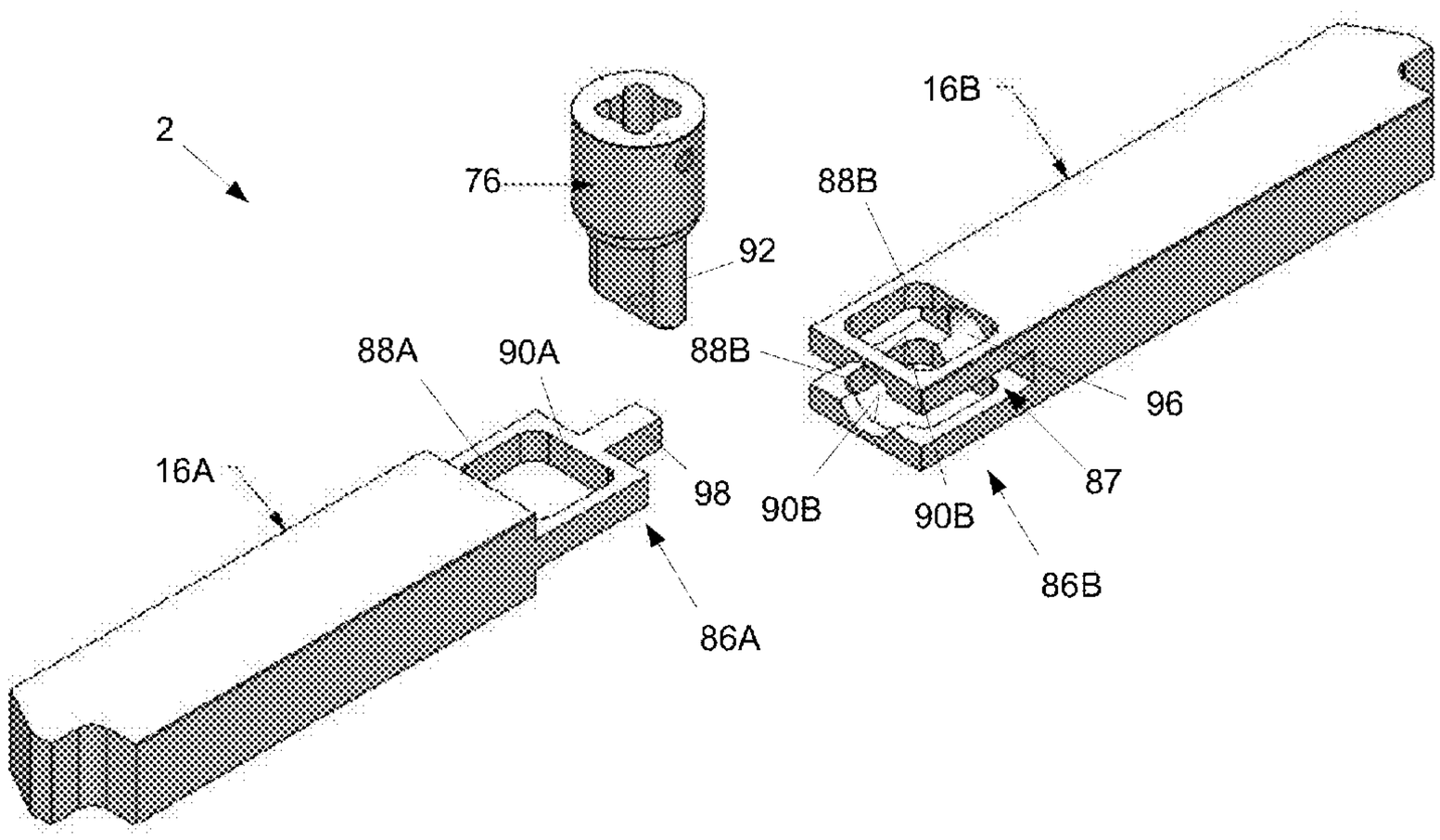



FIG. 6

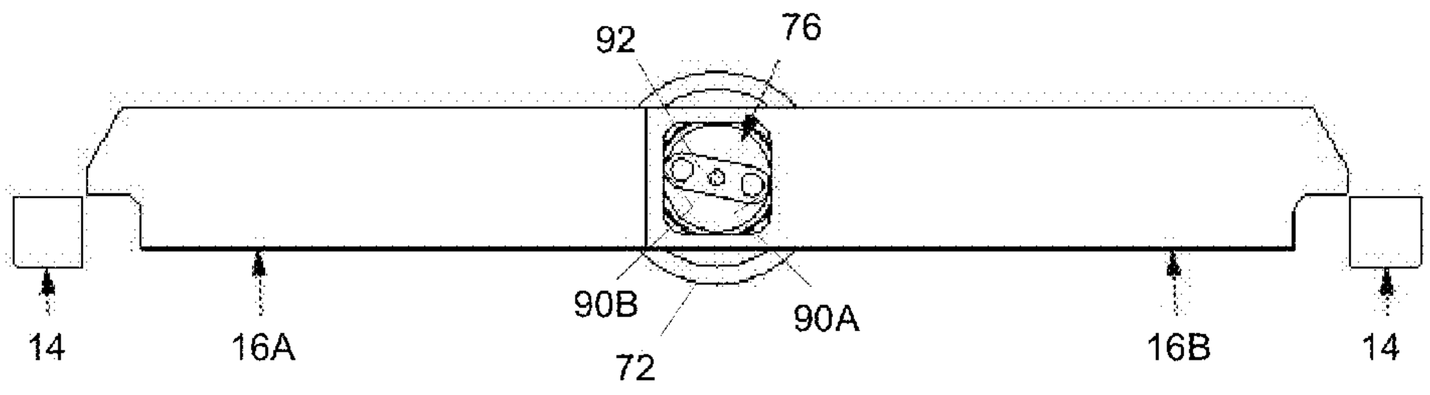



FIG. 7A

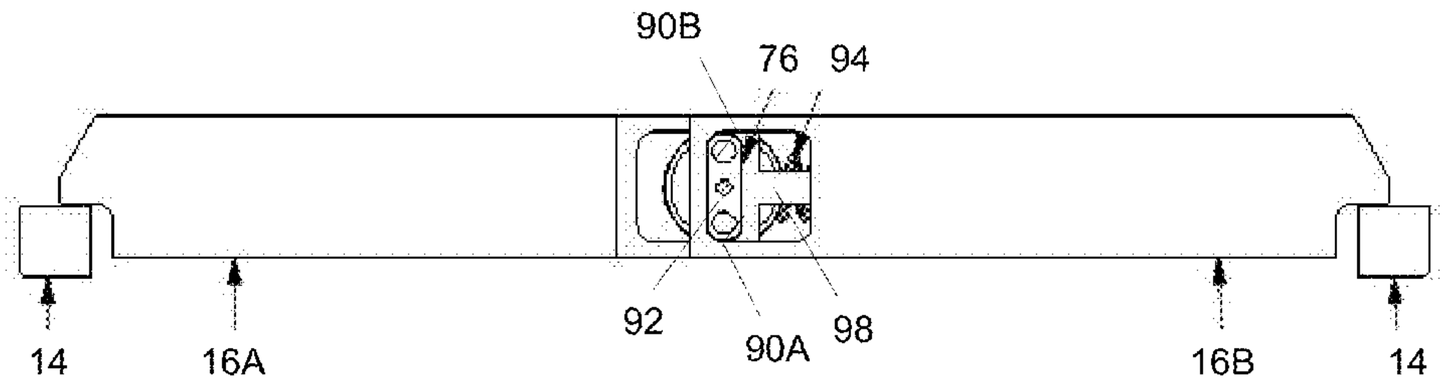
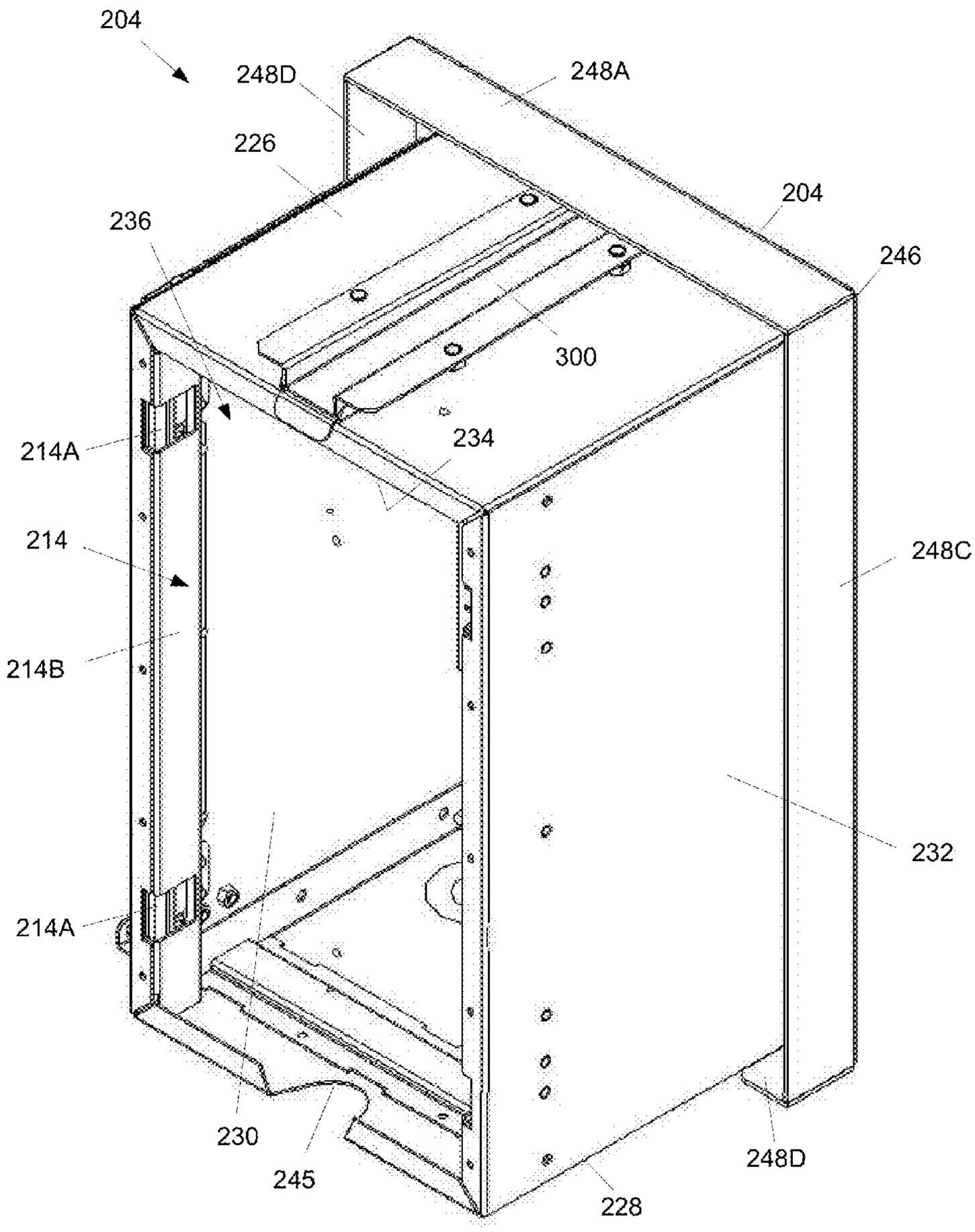



FIG. 7B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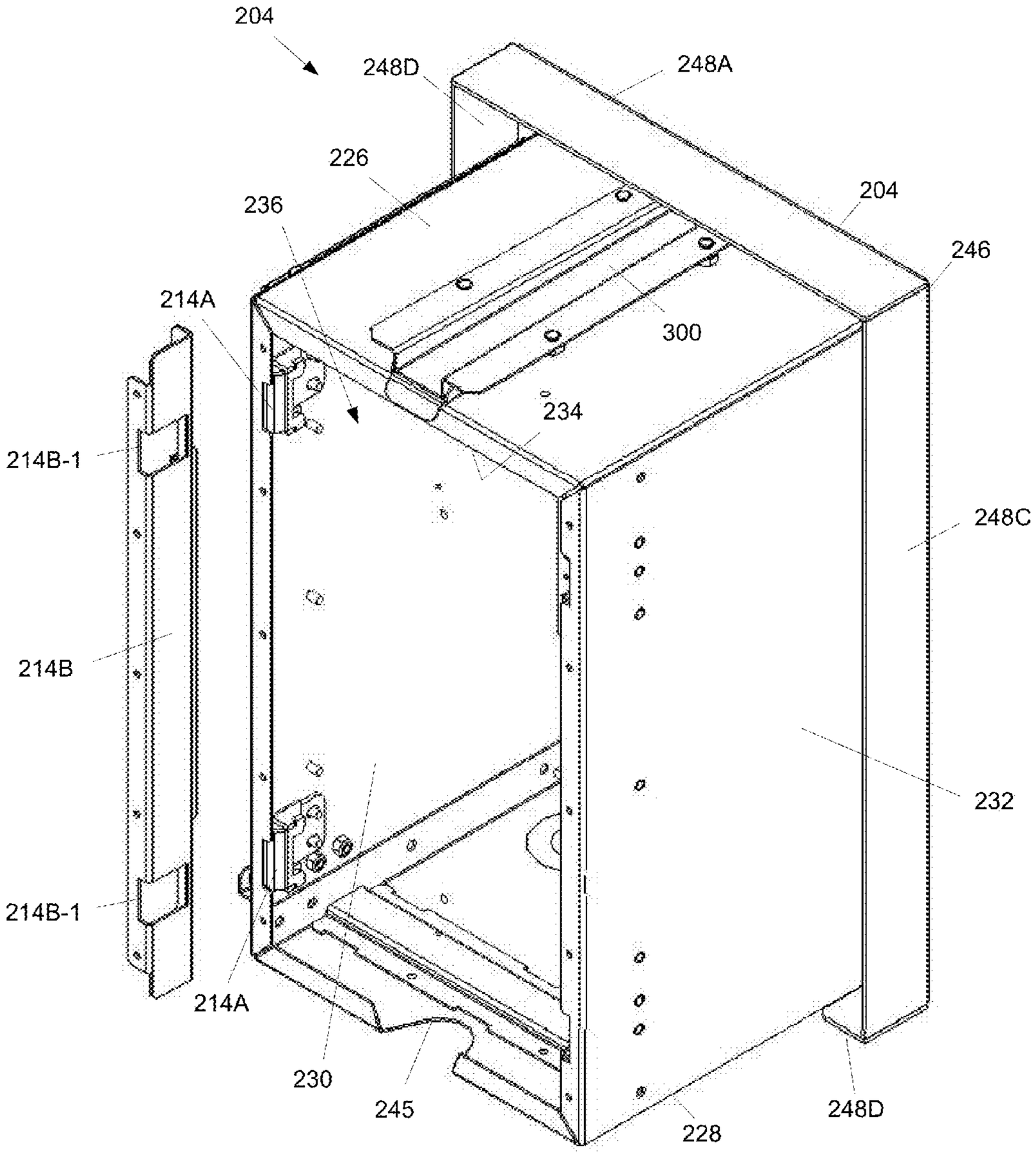
248D
248A
226
204
236
246
300
234
214A
214
248C
214B
232
214A
230
245
228
248D

FIG. 8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214B-1
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245
228
248D

FIG. 8A

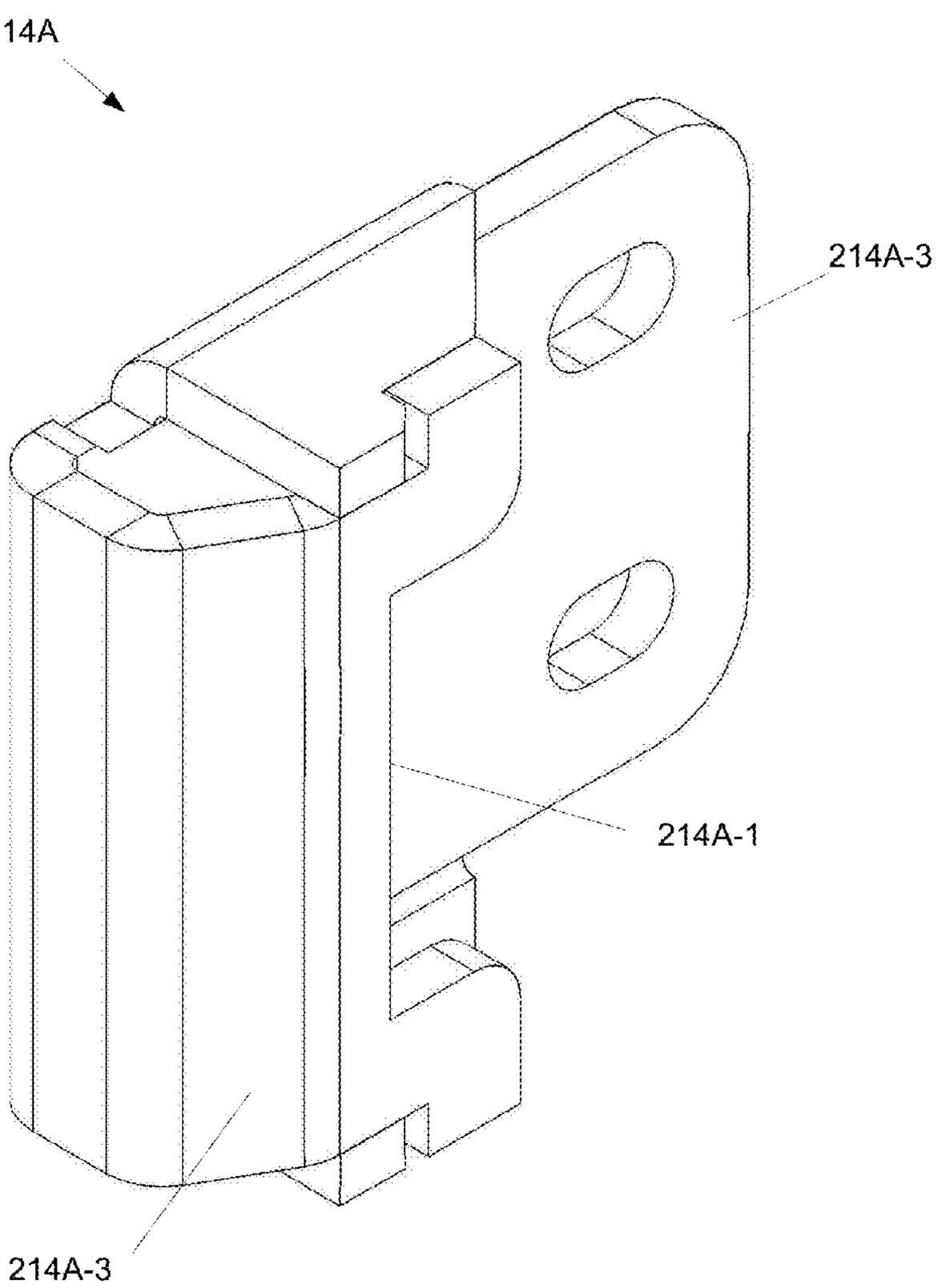



FIG. 8B

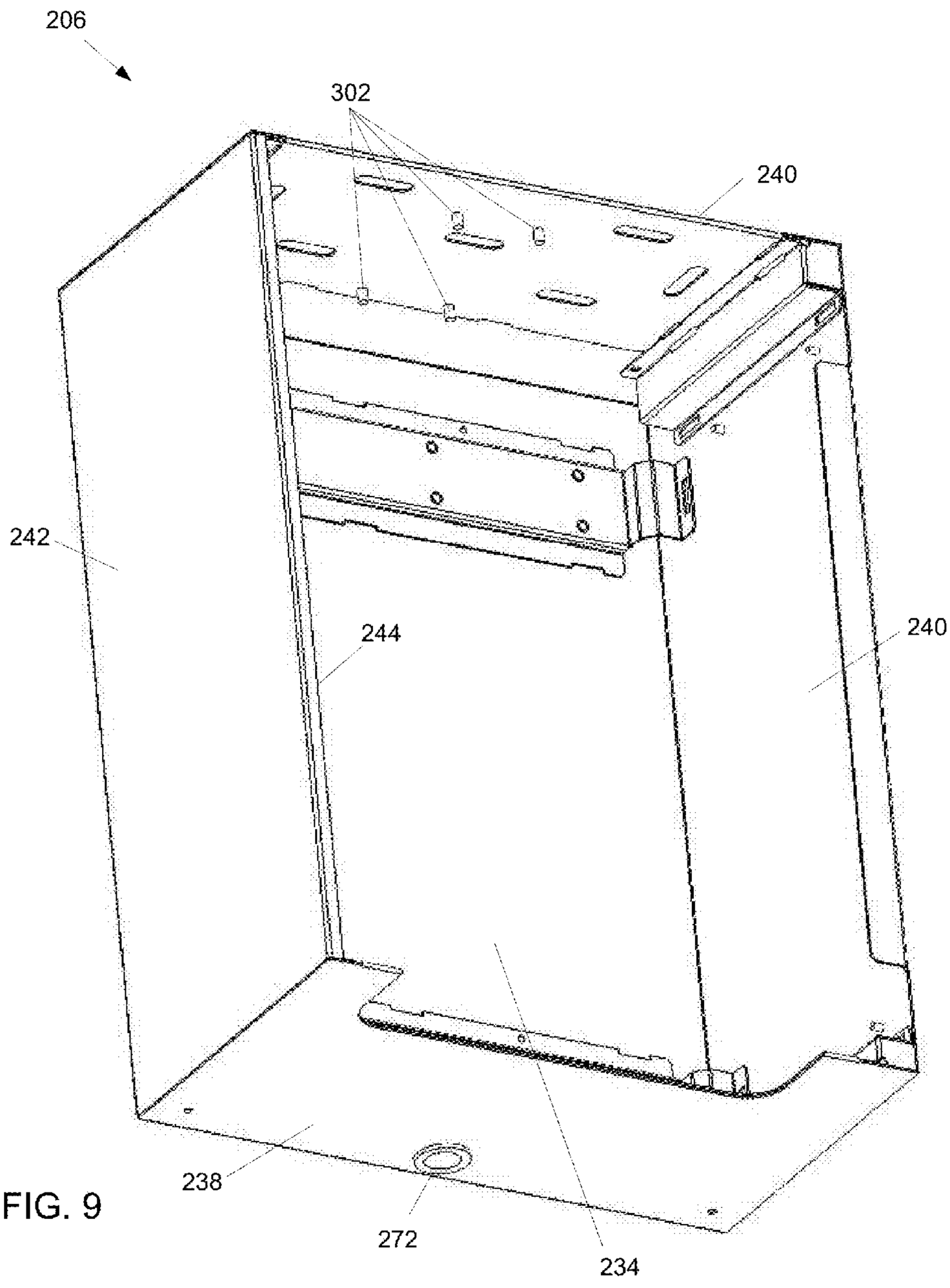
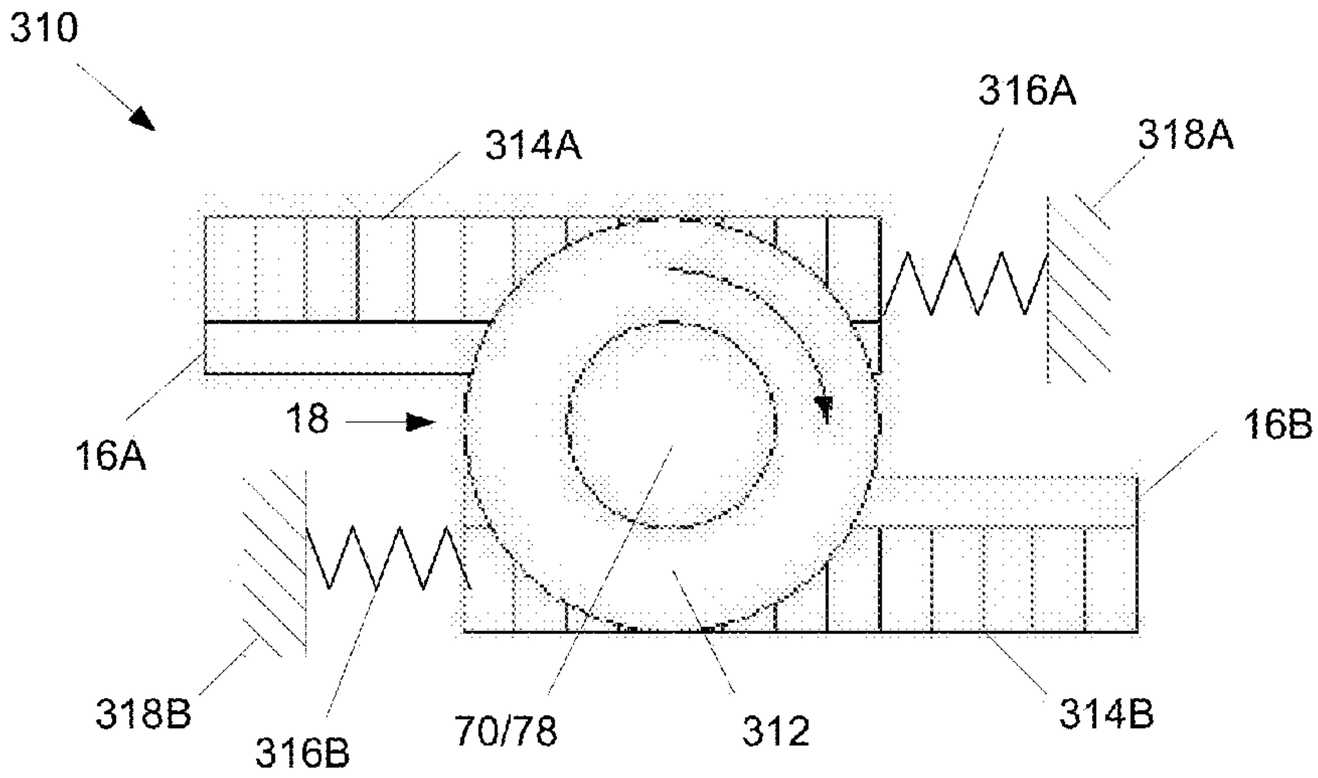



FIG. 9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318A
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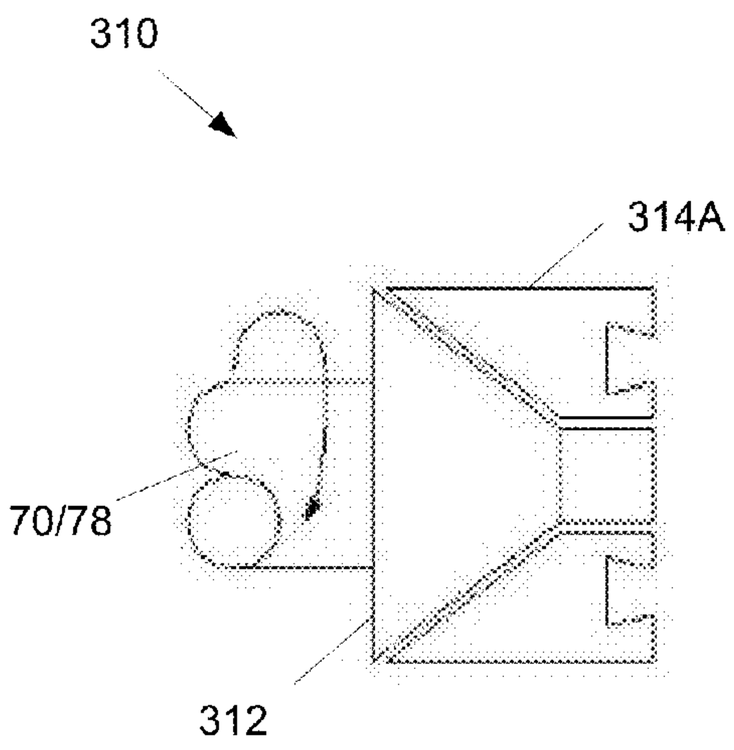
16A
16B
318B
316B
70/78
312
314B

FIG. 10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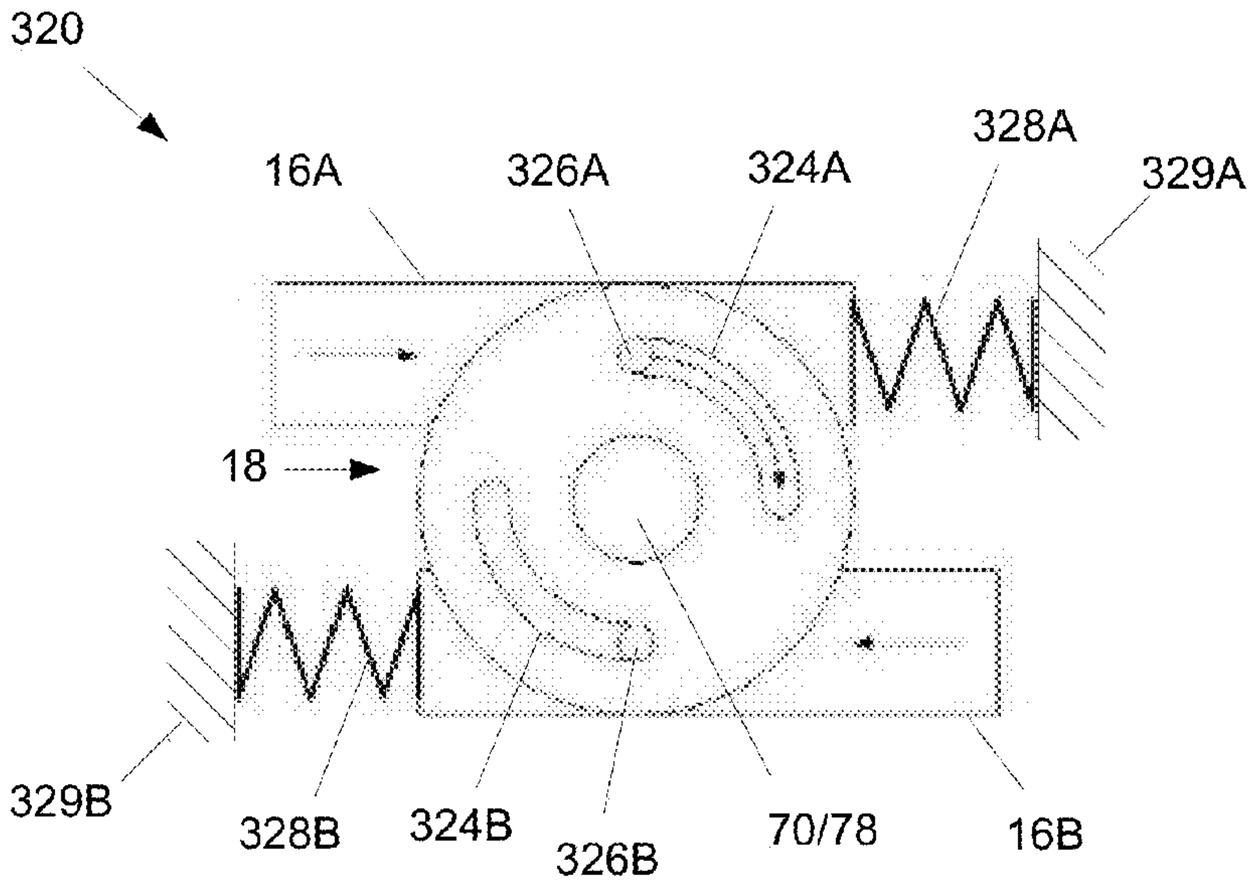
70/78
312

FIG. 11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16A
326A
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328A
329A
18
329B
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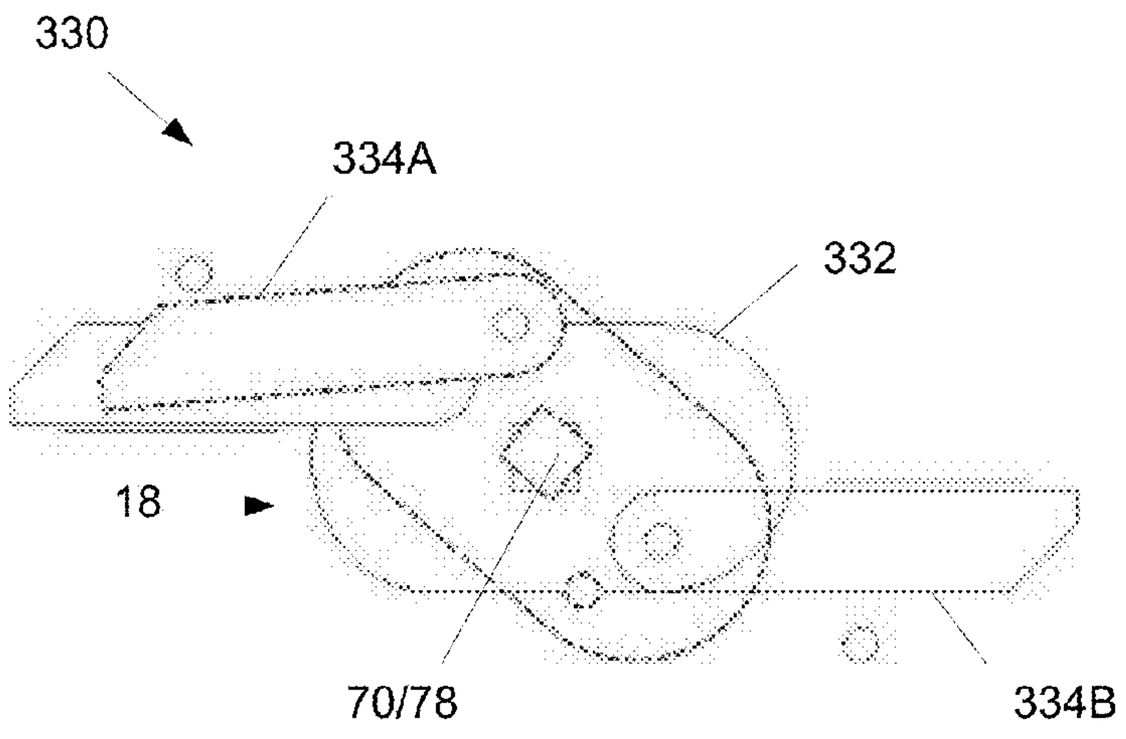
324B
326B
70/78
16B

FIG. 12


330
334A
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70/78
334B

FIG. 13

# HIGH-SECURITY ENCLOSURE

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit under 35 U.S.C. 119(e) of the filing date of U.S. Provisional Patent Application No. 61/162,429 filed on Mar. 23, 2009 and entitled "High-Security Enclosure. The entire contents of Application No. 61/162,429 are hereby incorporated herein by this reference.

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to lockable enclosures. More particularly, the invention concerns security enclosures for housing equipment, including but not limited to, electrical equipment, such as components for cable television, cable data, telephone and other communication systems.

2. Description of the Prior Art

By way of background, lockable enclosures have many uses. One application is for housing electrical equipment used for providing telecommunication services. For example, lockable security enclosures are commonly used to house junction connectors, taps, and other electrical components for communication systems that provide cable television, cable data, telephone and other network services to residential and business premises. Because such enclosures are often located in publicly accessible areas, they are usually provided with a security lock structure that prevents access for unauthorized purposes, such as making an illegal service hookup. It is to improvements in the security features of lockable enclosures that the present invention is directed.

## SUMMARY OF THE INVENTION

A high-security enclosure includes a base, a cover and a lock system. The lock system includes a base portion and a cover portion. The lock system base portion includes one or more fixed lock bars. The lock system cover portion includes one or more movable lock bars. Each movable lock bar is generally perpendicular to, and arranged to engage, one of the fixed lock bars. The lock system cover portion further includes a lock bar retraction assembly coupled to the one or more movable lock bars for retracting the movable lock bar(s) substantially simultaneously out of engagement with the fixed lock bar(s). A security drive mechanism is coupled to the lock bar retraction assembly to drive the lock system.

## BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the invention will be apparent from the following more particular description of example embodiments, as illustrated in the accompanying Drawings in which:

FIG. **1** is a perspective view showing an embodiment of high-security enclosure with a cover thereof in an open position relative to an enclosure base;

FIG. **2** is a perspective viewing the complete enclosure lock system;

FIG. **3** is an exploded perspective view showing additional details of the enclosure lock system;

FIG. **4** is a cross-sectional view of the enclosure of FIG. **1** with the cover thereof in a closed position and looking downwardly on a portion of an enclosure lock system;



FIG. **4**A is a cross-sectional view looking in the direction of arrows **4**A-**4**A in FIG. **4** showing part of an upper hinge assembly of the enclosure of FIG. **1**;

FIG. **5**A is a top plan view showing the enclosure of FIG. **1** with the cover in a closed position;

FIG. **5**B is a diagrammatic top plan view corresponding to FIG. **5**A but with only a hinge portion of the cover being shown in relation to the enclosure base;

FIG. **5**C is a top plan view showing the enclosure of FIG. **1** with the cover in a partially open position;

FIG. **5**D is a diagrammatic top plan view corresponding to FIG. **5**C but with only a hinge portion of the cover being shown in relation to the enclosure base;

FIG. **5**E is a top plan view showing the enclosure of FIG. **1** with the cover in a fully open position;

FIG. **5**F is a diagrammatic top plan view corresponding to FIG. **5**E but with only a hinge portion of the cover being shown in relation to the enclosure base;

FIG. **6** is an exploded perspective view showing further details of the enclosure lock system;

FIG. **7**A is a top plan view showing an unlocking position of the enclosure lock system;

FIG. **7**B is a top plan view showing a locking position of the enclosure lock system;

FIG. **8** is a perspective view showing the base of an alternative embodiment of a high-security enclosure with an alternative fixed lock bar assembly;

FIG. **8**A is a perspective view showing the base of FIG. **8** with a stiffener portion of the fixed lock bar assembly removed to illustrate a catch portion thereof;

FIG. **8**B is an enlarged perspective view showing the catch portion of the fixed lock bar arrangement of FIG. **8**A;

FIG. **9** is a perspective view showing a partially assembled cover designed to mount to the base of FIG. **8**;

FIG. **10** is a diagrammatic plan view showing the operation of an alternative enclosure lock system;

FIG. **11** is a diagrammatic side elevation view showing the alternative enclosure lock system system of FIG. **10**;

FIG. **12** is a diagrammatic plan view showing the operation of a further alternative enclosure lock system; and

FIG. **13** is a diagrammatic plan view showing the operation of a still further alternative enclosure lock system.

## DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

Turning now to the drawing figures, wherein like reference numbers represent like elements in all of the several views, FIG. **1** illustrates an example construction of a high-security enclosure **2**. The enclosure **2** may be used for a variety of enclosure applications, including but not limited to, as an equipment enclosure for housing electrical components, such as for telecommunication system use. The enclosure **2** includes a base **4** and a cover **6**. The base **4** and the cover **6** can be fabricated from any suitable material, including but not limited to, a durable metal such as stainless steel, a polymer-based composite material, or any other high strength metal or non-metal material that is preferably resistant to corrosion and other types of environmental degradation. Unless otherwise indicated, the remaining components of the enclosure (to be described in more detail below) may be formed from the same or similar materials.

As additionally shown in FIG. **2**, the enclosure **2** further includes a lock system **8** for locking the cover to the base. The lock system **8** includes a base portion **10** on the base **4** and a cover portion **12** on the cover **6**. The lock system base portion **10** includes a pair of first and second fixed lock bars **14**

arranged in mutually parallel spaced relationship with each other. The lock system cover portion **12** includes one or more sets **16** of movable lock bars. In the example embodiment shown in FIGS. **1** and **2**, two movable lock bar sets **16** are arranged in mutually parallel spaced relationship with each other. Additional movable lock bar sets could be added for enclosures of larger size. Alternatively, for smaller enclosures, a single movable lock bar set may suffice.

In the illustrated embodiment, each fixed lock bar **14** is formed from a single piece of bar stock made from steel or other high-strength material that is configured in the manner shown in FIG. **2**. Each movable lock bar set **16** includes first and second movable lock bars **16**A and **16**B that can also be formed from steel bar stock made from steel or other high-strength material. The movable lock bars **16**A and **16**B are generally perpendicular to, and arranged to respectively engage, the first and second fixed lock bars **14**. The locations where the movable lock bars **16**A and **16**B engage the fixed lock bars **14** will be referred to hereinafter as fixed lock bar catch portions (due to the fact that they retain the movable lock bars). The elongated span of the fixed lock bars **14** that lies between the catch portions will be referred to hereinafter as fixed lock bar stiffener portions (due to the fact that they stiffen the portions of the base on which the fixed lock bars are mounted). Depending on the number and location of the movable lock bar sets **16**, the fixed lock bar stiffener portions may also extend above and below the fixed lock bar catch portions.

The lock system cover portion **12** further includes a lock bar retraction assembly **18** coupled to the movable lock bar sets **16** for retracting the movable lock bars **16**A and **16**B (preferably substantially simultaneously) out of engagement with the fixed lock bars **14** as the retraction assembly is rotated. The operation of the lock system **8** is described in more detail below. For now, it is sufficient to note that the movable lock bars have a refracted unlocked position (as shown in FIG. **7**A) when the lock bar refraction assembly **18** is in one rotational orientation, and an extended lock position (as shown in FIG. **7**B) when the retraction assembly is in a second rotational orientation. By way of example only, the first and second rotational orientations are approximately 90 degrees apart.

In the illustrated embodiment (with two movable lock bar sets **16**), the lock system cover portion **12** is generally "I" shaped when the enclosure **2** is oriented as shown in the drawings. If the enclosure **2** was rotated 90 degrees, the lock system cover portion **12** would be generally "H" shaped. In either case, the lock system cover portion **6** lies generally parallel to the cover's front face. A security drive mechanism **20** is coupled to the refraction assembly **18** to drive the lock system **8**. In an example embodiment shown in FIG. **3**, the drive mechanism **20** comprises a lock **22** (e.g. a lock bolt) on the lock bar retraction assembly **18** that is configured to receive a security key (not shown) for rotating the refraction assembly. Although not shown, the face of the security lock **22** may have a curvilinear groove or ridge that matches a corresponding groove or ridge on the security key. Other designs that allow a security key to rotate the security lock **22** may also be used. Other types of security drive mechanism may also be provided, including but not limited to, motorized drive systems that may be key-operated or operated electronically, such as by using a radio control device in wireless communication with one or more servo drive units within the enclosure **2** that interoperate with the retraction assembly **18**.

With additional reference now to FIG. **4**, the cover **6** may be configured to enclose the base **4** in a nested relationship. In the illustrated embodiment, which represents only one example construction of the enclosure **2**, the base **4** is formed with a back panel **24** and a set of four rectangular depth panels. As shown in FIG. **1**, the base depth panels include an upper panel **26** and a bottom panel **28**. As shown in both of FIGS. **1** and **4**, the base depth panels further include two side panels **30** and **32**. The base depth panels **24-32** extend forwardly from the peripheral edge of the back panel **24**. As can be seen in FIG. **1**, the back panel **24** and the depth panels **24-32** are arranged to form a rectangular box having a front opening **34** that leads to an equipment holding interior region **36** of the enclosure **2**. The base depth panels **26-32** have a selected width dimension that defines a depth of the enclosure interior region **36**.

The cover **6** has a front face panel **38** and its own set of four depth panels. As shown in FIG. **1**, the cover depth panels include an upper panel **40** and a bottom panel **41**. As shown in both of FIGS. **1** and **4**, the cover depth panels further include two side panels **42** and **43**. The cover depth panels **40-43** extend rearwardly from the peripheral edge of the face panel **38**. As can be seen in FIG. **1**, the face panel **38** and the cover depth panels **40-43** are arranged to form a rectangular box having a rear opening **44** that is larger than the front opening **34** of the base **4**, thereby allowing the cover **6** to slide over the base. The cover depth panels **40-43** have a width dimension that is equal to or larger than the width dimension of the base depth panels **24-32**. This allows the base **4** to completely nest within the cover **6** for added security against unauthorized access. A base bottom panel cutout **45** accommodates the components of drive mechanism **20**.

With continuing reference to FIGS. **1** and **4**, the enclosure **2** may be further provided with a backplate **46** that can be mounted to the back panel **24** of the base **4**. The backplate **46** has a peripheral lip **48** that encloses portions of the back edge of the cover **6** when the latter is locked to the base **4** by the lock system **8**. The backplate peripheral lip **48** is formed by flanges that are spaced from the base panels **26-32**. These flanges include a top flange **48**A, a pair of side flanges **48**B and **48**C, and a partial (or complete) bottom flange **48**D. The backplate peripheral lip **48** provides additional security against unauthorized access into the enclosure **2**.

The cover **6** is both pivotally and slidably mounted to the base **4**. With reference to FIGS. **4** and **4**A, the base **4** may include a pair of hinge mounts **50** attached to one of the base side panels (e.g., side panel **30**) proximate to the base top and bottom panels **26** and **28**. For larger enclosures, additional hinge mounts **50** may be provided. Each hinge mount **50** carries a hinge pin **52**. The cover **6** includes a pair of slot members **54** having elongated slots **56** that ride on the hinge pins **52**. The slots **56** are sufficiently long to allow the cover **6** to be pulled clear of its nested relationship with the box **4** during opening, at which point the cover can be pivoted to its fully open position. A reverse action is used for closing the cover. FIGS. **5**A-**5**F illustrate several cover positions. FIG. **5**A shows the cover **6** in its fully closed position. FIG. **5**B shows the corresponding relationship between the base hinge mounts **50** and the cover slot members **54** in this position. FIG. **5**C shows the cover **6** in a partially open position after it is has been pulled away from the base **4** to the full extent of the slidable range permitted by the cover slot members **54**, but prior to the initiation of cover pivoting. FIG. **5**D shows the corresponding relationship between the base hinge mounts **50** and the cover slot members **54** in this position. FIG. **5**E shows the cover **6** after it has been pivoted and the cover is at or near its fully open position. FIG. **5**F shows the corresponding relationship between the base hinge mounts **50** and the cover slot members **54** in this position.

Returning now to FIGS. **1** and **4**, the fixed lock bars **14** can be mounted to the base side panels **30** and **32**. Preferably, the

stiffener portions of the fixed lock bars **14** have higher stiffness than the side panel sheet structure. In the illustrated embodiment where the lock bars **14** are formed out of high-strength bar stock, the stiffener portions will be stiffer than the relatively thin sheet stock normally used to form the base side panels **30** and **32**. An alternative fixed lock bar configuration is described below in connection with FIGS. **8-9**. A rigid lock bar design provides improved security by resisting disengagement of the lock system base and cover portions **10** and **12** due to deformation of the base **4**. As shown in FIGS. **1-3**, the catch portions of the fixed lock bars **14** may be formed with angled striker plate surfaces **56** for retracting the ends of the movable lock bars **16**A and **16**B (which are themselves angled) when the cover **6** is closed.

In the illustrated embodiment, the fixed lock bars may also optionally include one or more apertures **57** (e.g., two) proximate to each catch portion where the fixed lock bars engage the movable lock bars **16**A and **16**B. The cover **6** may then optionally include registration pins **58** that are received in the apertures **57** when the cover **6** is locked to the base **4** by the lock system **8**. This engagement of the registration pins **58** in the apertures **57** provides improved security by resisting disengagement of the lock system base and cover portions **10** and **12** due to deformation of the base **4**. It also helps maintain the cover **6** in a proper orientation with respect to the base **4**. An alternative cover guide design is described below in connection with FIGS. **8-9**.

As can be seen in FIGS. **1**, **3** and **4**, the movable lock bars **16**A and **16**B are slidable within bracket assemblies **60** mounted on the cover front panel **38**. As best shown in FIG. **3**, the bracket assemblies **60** may each include a U-shaped bracket component **62**, a base plate **64** and a stiffening backing member **66**. The bracket assemblies **60** are preferably stiff relative to the cover front panel **38**. This provides improved security by resisting disengagement of the lock system base and cover portions **10** and **12** due to deformation of the cover **6**. The stiffening backing member **66** of each bracket assembly **60** is attached to the cover front panel **38**. It may be used to support the base of the registration pins **58** within a pair of vertical channels **68**. The channels **68** are sized and arranged to receive the fixed lock bars **14** when the cover **6** is locked to the base **4** by the lock system **8**.

As can be seen in FIGS. **2** and **3**, the lock bar retraction assembly **18** includes a lower first actuator **70** as part of the drive mechanism **20**. The drive mechanism **20** may also include a cup **72** in which the security lock **20** is disposed for protection from the elements. A clip **74** may be used to captivate the lock **22** into the cup **72** and the first actuator **70**. A lower first cam **76** is driven by the first actuator **70** and is operatively coupled to a lower first one of the movable lock bar sets **16**. An upper second actuator **78** is driven by the lower cam **76**. A shroud **80** may be provided that spins freely around the second actuator **78**. An upper second cam **82** is driven by the second actuator **78** and is operatively coupled to an upper second one of the movable lock bar sets **16**. An upper cap **84** is mounted to the upper cam **82** at the top of the lock bar refraction assembly **18**.

FIGS. **6**, **7**A and **7**B illustrate the lower movable lock bar set **16** that is driven by the lower cam **76**. As shown, the first and second movable lock bars **16**A and **16**B have nested cam-engaging ends **86**A and **86**B, respectively, that are arranged to slide relative to each other along a common axis when driven by the lower cam **76**. Although not illustrated, the upper movable lock bar set **16** and the upper cam **82** are constructed in identical fashion. It will be seen that the cam-engaging end **86**B of the movable lock bar **16**B is forked to provide a gap **87** for slidably receiving the cam-engaging end **86**A of the movable lock bar **16**A. The movable lock bar cam-engaging ends **86**A and **86**B respectively include overlapping cam-receiving slots **88**A and **88**B. Because the cam-engaging end **86**B of the movable lock bar **16**B is forked, it has two cam-receiving slots **88**B, one upper and one lower. Each cam-receiving slot **88**A and **88**B is formed with a respective cam-follower end member **90**A and **90**B. Again, because the cam-receiving slot **88**B is forked, it has two cam-follower end members **90**B, one upper and one lower.

The cam **76** has an elongated cam member **92** that is trapped within the interior of the overlapping cam-receiving slots **88**A and **88**B in order to engage the opposing cam-follower end members **90**A and **90**B. When the lock bar retraction assembly **18** is in its non-refracting rotational position, the narrow dimension of the cam member **92** engages the cam-follower end members **90**A and **90**B, as shown in FIG. **7**B. When the lock bar refraction assembly **18** is in its retracting rotational position, the cam member **92** is rotated so that its wide dimension pushes apart the cam-follower end members **90**A and **90**B. This increases the amount of overlap of the movable lock bars **16**A and **16**B, and refracts them out of engagement with the fixed lock bars **14**. Note that the long dimension of the cam member **92** and the width of the cam-receiving slots **88**A and **88**B may be enlarged in order to increase the throw of the movable lock bars **16**A and **16**B during retraction. Similarly, reducing these dimensions (or at least the long dimension of the cam member **92**) will decrease the movable lock bar throw. As previously mentioned, the configuration and operation of the upper movable lock bar set **16** is exactly the same.

The first and second movable lock bars **16**A and **16**B of the upper and lower movable lock bar sets **16** can be resiliently biased into engagement with the fixed lock bars **14**. As shown in FIG. **7**B, this biasing may be provided by a coil compression spring **94**. One end of the spring **94** is captured in a blind bore **96**, which can be seen in FIG. **6** at the base of the fork gap **87** of the movable lock bar **16**B. The other end of the spring **94** engages the movable lock bar **16**B. In particular, the spring **94** is received on a post **98** that extends from the cam-engaging end **86**A of the movable lock bar **16**A. The post **98** helps stabilize the spring **94**. It is sized to be received in the blind bore **96** of the movable lock bar **16**B.

It will be seen in FIG. **3** that the upper and lower pairs of movable lock bars **16**A and **16**B are nested together within the upper and lower U-shaped bracket components **62** and base plates **64** of the bracket assemblies **60**. The compression spring **94** acts between the movable lock bars **16**A and **16**B so that these bars are forced outwardly into engagement with the fixed lock bars **14**. Nesting together the ends of the movable lock bars **16**A and **16**B creates upper and lower cam-receiving pockets **98**, each of which is provided by the overlapping cam-receiving slots **88**A and **88**B formed at the cam-engaging ends **86**A and **86**B of the lock bars. The cam-receiving pockets **98** are shown as being located on the centerline of the cover lock assembly **12**, which is also the centerline of the lock bar retraction assembly **18**. Depending on design preferences, the cover lock assembly **12** also could be designed so that the lock bar retraction assembly **18** and the cam-receiving pockets **98** are offset from the cover lock assembly centerline.

Still referring to FIG. **3**, the cover lock assembly **12** may be assembled in the following manner. The first actuator **70** may be inserted through a lower one of a pair of circular openings **100** formed in the lower U-shaped bracket component **62**. The lower cam **76** is likewise inserted through an upper one of the circular openings **100** in the lower U-shaped bracket component **62**. With the lower lock bars **16**A and **16**B pushed toward each other to form the lower cam-receiving pocket **98**, and the

lower cam **76** is advanced into this pocket. Two pins **102** on the first actuator **70** engage a pair of holes **104** that are formed in both the lower cam **76** and the upper cam **82** (note that only the upper cam holes **104** are visible in FIG. **3**). This coupling forces the the first actuator **70** and the lower cam **76** to rotate together. There is an upwardly-facing shoulder **104** on the first actuator **70** and a downwardly-facing shoulder **106** on the lower cam **76**. Each shoulder **104** and **106** is larger than the circular openings **100** in the lower U-shaped bracket component **62** in order to keep the first actuator **70** and the lower cam **76** from sliding through the lower bracket assembly **60**. The first actuator **70** and the lower cam **76** may be held together using a small coupling screw (not shown) inserted through a clearance pocket **108** in the side of the first actuator. The coupling screw extends upwardly through a small hole **109** in the top of the actuator **70** and is received in a threaded bore (not shown) formed at the bottom of the cam member **92** of lower cam **76**. This creates a lower subassembly of the lock system cover portion **12**.

An upper subassembly of the lock system cover portion **12** may be assembled in similar fashion. The upper cam **82** can be inserted through a lower one of a pair of circular openings **110** formed in the upper U-shaped bracket component **62**. With the upper lock bars **16**A and **16**B pushed toward each other to form the upper cam-receiving pocket **98**, and the upper cam **82** is advanced into this pocket. The upper cap **84** is then inserted into an upper one of the circular openings **110** in the upper U-shaped bracket channel component **62**. The upper cap **62** and the upper cam **82** are held together with a small coupling screw (not shown). The coupling screw extends downwardly through a small hole **111** in the top of the upper cap **84** and is received in a threaded bore **112** formed at the top of the cam member **92** of upper cam **82**. This creates the upper subassembly of the lock system cover portion **12**. There is a shoulder **114** on the upper cam **82**, as well as a shoulder **116** on the upper cap **84**. Each shoulder **114** and **116** is larger than the circular openings **110** in the upper U-shaped bracket component **62** in order to keep these components from sliding through the upper bracket assembly **60**.

The shroud **80** may now be slid over the second actuator **78**. As previously mentioned, the shroud **80** is sized to spin freely around the second actuator **78** when the actuator is installed. The second actuator **78** may be configured with a square cross-section (e.g., as a square bar, a four-sided square tube, a three-sided channel, etc.). The upper and lower ends of the second actuator **78** are respectively inserted into square pockets **118** and **120** in the lower and upper cams **76** and **82**, and held in place using a small set screw (not shown). Note that instead of providing the square pockets **118** and **120**, the lower and upper cams **76** and **82** could each be formed with square posts that extend into corresponding square openings in the ends of the second actuator **78**. If the second actuator **78** is made from square tube or channel stock, such end openings would already exist. If the second actuator **78** is made from bar stock, the end openings would need to be fabricated. Other shapes could also be used to key the second actuator **78** to the cams **76** and **82**.

The foregoing assembly may now be attached to the cover **6** by bolting the upper and lower U-shaped brackets **62** (with the base plates **64**) to the upper and lower backing members **66**, which may be welded to the inside of the cover's front panel **38**. The lock bolt **22** is then inserted through an opening **122** in the top of the cup **72** and into a corresponding opening (not shown) in the bottom of the first actuator **70**. The lock bolt **22** contains a square extrusion **124** that engages into a square pocket **126** at the bottom within the first actuator **70**. The lock bolt **22** is secured in place by installing the retaining clip **74** through the clearance pocket **108** in the side of the first actuator **1** and around a groove (not shown) machined or otherwise formed in the lock bolt.

The lock bolt **22** is actuated through the engagement and rotation of a security key after the key is inserted into the cup **72**. The rotation of the lock bolt **22** forces rotation of the first actuator **70**, which in turn rotates the lower cam **76** of the lock system cover portion lower subassembly, the second actuator **78**, and the upper cam **82** of the lock system cover portion upper subassembly. This draws both sets of the movable lock bars **16**A and **16**B inwardly, causing them to disengage from both of the fixed lock bars **14**. Advantageously, clearances may be built into each of the parts to eliminate the need for bearings, bushings, or grease between the moving components.

Having now described an example embodiment of a high-security enclosure, it will be appreciated that the enclosure and its various components may be modified to provide various alternative embodiments. For example, it would be possible to modify the lock system **8** so that the fixed lock bars **14** are not elongated. In that case, there could be a pair of fixed lock bar segments on each side of the base that are respectively positioned to engage the upper and lower movable lock bar sets. These lock bar segments could be quite short, perhaps only long enough to engage the movable lock bars **16**A and **16**B. According to another embodiment, it would be possible to integrate the fixed lock bars **14** with the base side panels **30** and **32**, as for example, by forming the base **2** as a molded structure made from a high strength polymer, or to provide such integrated lock bars with additional strength members (such as steel reinforcement plates).

FIG. **8** illustrates another alternative embodiment in which the enclosure **2** utilizes a modified enclosure base **204** with a modified fixed lock bar configuration and a modified design for orienting the enclosure base and cover portions. Except as described herein, the base **204** is identical to the base **4**, as shown by the use of corresponding reference numbers that are incremented by **200**. The base **204** differs from the previously described base **4** in that the fixed lock bars **214** are formed as lock bar assemblies that includes several components. In particular, as additionally shown in FIGS. **8**A and **8**B, the lock bar **214** includes a pair of catch fittings **214**A and a stiffener **214**B. The catch fittings **214**A may be formed from steel sheet stock into the configuration shown in FIG. **8**B. In this configuration, the catch fittings **214**A include a catch portion **214**A-**1** that catches and retains the movable lock bars **16**A and **16**B when the cover **6** is closed. The catch fittings **214**A also include an angled striker plate portion **214**A-**1** that engages and depresses the angled ends of the movable lock bars **16**A and **16**B C as the cover **6** is closing. The catch fittings **214**A further include a mounting portion **214**A-**3** that may be formed with apertures for receiving mounting bolts for attaching the catch fittings to the base **204**. As shown in FIG. **8**A, the stiffener **214**B is formed as a channel member with a pair of openings **214**B-**1** that are sized to expose the catch fittings **214**A. The stiffener **214**B also includes mounting flanges for attaching the stiffener to the base **204**.

FIGS. **8** and **8**A further illustrate that the base **204** may include a post guide channel **300** mounted to the top depth panel **226**. FIG. **9** illustrates a modified cover **206** whose top depth panel **240** is formed with guide posts **302**. The cover guide posts **302** are positioned to engage the sides of the post guide channel **300** as the cover **206** is closed. This engagement helps guide the cover **206** during the closure operation.

According to a further design modification of the lock system **8**, there may be a single fixed lock bar **14** or **214** on the side of the base **2** or **206** that is opposite from the hinge

connection(s) to the cover **6**. The lock system cover portion **12** may then be redesigned so that the movable lock bar sets **16** are each reduced to only a single lock bar that engages the single fixed lock bar. This modification may also require that the cover-base hinge connection allow pivoting only, with no sliding motion.

Turning now to FIGS. **10** and **11**, an alternative connection arrangement **310** is shown that may be used for interconnecting the lock bar retraction assembly **18** to the movable lock bars **16**A and **16**B. The connection arrangement **310** is a gear drive system wherein upper and lower bevel gears **312** on the lock bar retraction assembly **18** engage upper and lower pairs of rack gears **314**A and **314**B on the upper and lower sets of movable lock bars **16**A and **16**B. In this embodiment, the cams **76** and **82** are not used. The lower bevel gear **312** can be driven by a modified version of the first actuator **70** and the upper bevel gear **312** can be driven by a modified version of the second actuator **78**. Lock bar biasing to the locking position may be provided by compression springs **316**A and **316**B. The springs **316**A and **316**B may respectively engage the rack gears **314**A and **314**B, and may be respectively anchored to fixed structures **318**A and **318**B formed as part of the bracket assemblies **60**. Other biasing arrangements could also be used.

FIG. **12** illustrates another alternative connection arrangement **320** that may be used for interconnecting the lock bar retraction assembly **18** to the movable lock bars **16**A and **16**B. In the connection arrangement **320**, a pair of upper and lower cam wheels **322** on the lock bar retraction assembly **18** each have arcuate cam slots **324**A and **324**B that respectively drive pins **326**A and **326**B on the movable lock bars **16**A and **16**B. In this embodiment, the cams **76** and **82** are not used. The lower cam wheel **322** can be driven by a modified version of the first actuator **70** and the upper cam wheel **322** can be driven by a modified version of the second actuator **78**. Lock bar biasing to the locking position may be provided by compression springs **328**A and **328**B. The springs **320**A and **320**B may respectively engage the movable lock bars **16**A and **16**B, and may be respectively anchored to fixed structures **329**A and **329**B formed as part of the bracket assemblies **60**. Other biasing arrangements could also be used.

FIG. **13** illustrates another alternative connection arrangement **330** that may be used for interconnecting the lock bar refraction assembly **18** to the movable lock bars **16**A and **16**B. In the connection arrangement **330**, a double-ended crank **332** on the lock bar retraction assembly **18** whose ends are pinned to intermediate links **324**A and **324**B that are also pinned to the movable lock bars **16**A and **16**B (not shown). In this embodiment, the cams **76** and **82** are not used. The lower crank **332** can be driven by a modified version of the first actuator **70** and the upper crank **332** can be driven by a modified version of the second actuator **78**. Lock bar biasing to the locking position may be provided by compression springs (not shown) that engage the movable lock bars **16**A and **16**B in the manner shown in FIG. **12**. Other biasing arrangements could also be used.

Accordingly, a high-security enclosure has been disclosed. Although several example embodiments have been shown and described, it should be apparent that many variations and additional alternative embodiments could be implemented in accordance with the teachings herein. It is understood, therefore, that the invention is not to be in any way limited except in accordance with the spirit of the appended claims and their equivalents.

What is claimed is:

**1**. A high-security enclosure, comprising:

a base;

a cover;

said cover having side portions configured to enclose side portions of said base in a nested relationship;

a lock system for locking said cover to said base;

said lock system including a base portion on said base and a cover portion on said cover;

said lock system base portion including a pair of first and second fixed lock bars arranged in mutually parallel spaced relationship with each other;

said lock system cover portion including one or more sets of movable lock bars arranged in mutually parallel spaced relationship with each other;

each movable lock bar set including first and second movable lock bars that are generally perpendicular to, and arranged to respectively engage, said first and second fixed lock bars;

said lock system cover portion further including a lock bar retraction assembly coupled to said movable lock bar sets for refracting said movable lock bars out of engagement with said fixed lock bars; and

a security drive mechanism coupled to said lock bar refraction assembly to drive said lock system.

**2**. The enclosure of claim **1** wherein said fixed lock bars each include one or more catch members for engaging a movable lock bar of said one or more movable lock bar sets.

**3**. The enclosure of claim **1** wherein said fixed lock bars each include at least two catch members.

**4**. The enclosure of claim **1** wherein said fixed lock bars are elongated.

**5**. The enclosure of claim **1** wherein said fixed lock bars are stiff relative to a portion of said base on which said fixed lock bars are mounted to provide improved security by resisting disengagement of said lock system base and cover portions due to deformation of said base.

**6**. The enclosure of claim **1** wherein said fixed lock bars each include one or more catch portions for engaging a movable lock bar of said one or more movable lock bar sets, and a stiffener portion for stiffening portions of said base on which said fixed lock bars are mounted.

**7**. The enclosure of claim **6** wherein said one or more catch portions and said stiffener portion are integrally formed on a piece of bar stock.

**8**. The enclosure of claim **6** wherein said one or more catch portions are provided by one or more catch fittings and said stiffener portion is provided by a separate stiffener channel.

**9**. The enclosure of claim **8** wherein said stiffener channel mounts over said one or more catch fittings and includes apertures for exposing said one or more catch fittings.

**10**. The enclosure of claim **1** wherein said fixed lock bars include at least one aperture proximate to each location where said fixed lock bars engage said movable lock bars, and wherein said cover includes registration pins that are received in said apertures when said cover is locked to said base by said lock system, said engagement of said registration pins in said apertures providing improved security by resisting disengagement of said lock system base and cover portions due to deformation of said base.

**11**. The enclosure of claim **1** wherein said movable lock bars are slidable within bracket assemblies mounted on said cover, said bracket assemblies being stiff relative to portions of said cover on which said bracket assemblies are mounted to provide improved security by resisting disengagement of said lock system base and cover portions due to deformation of said cover.

**12**. The enclosure of claim **11** wherein said bracket assemblies each include a stiffening backing member mounted to said cover.

13. The enclosure of claim 1 wherein said cover includes one or more guide posts that register with one or more corresponding post guides on said base.

14. The enclosure of claim 13 wherein said base further includes one or more backplate flanges that enclose back edges of one or more of said cover side portions when said cover encloses said base.

15. The enclosure of claim 1 wherein said lock system cover portion is generally "I" or "H" shaped and oriented parallel to a front wall of said cover.

16. The enclosure of claim 1 wherein said lock bar retraction assembly includes a first actuator driven by said security lock, a first cam driven by said first actuator and operatively coupled to a first one of said movable lock bar sets, a second actuator driven by said first cam, and a second cam driven by said second actuator and operatively coupled to a second one of said movable lock bar sets.

17. The enclosure of claim 16 wherein said first and second movable lock bars of each movable lock bar set have nested cam-engaging ends that are arranged to slide relative to each other along a common axis when driven by one of said cams.

18. The enclosure of claim 17 wherein said movable lock bar cam-engaging ends include overlapping cam-receiving slots that are each formed with a cam-follower end member, and wherein said first and second cams are each trapped within a pair of said overlapping cam-receiving slots in order to engage an opposing pair of said cam-follower end members.

19. The enclosure of claim 18 wherein said first and second movable lock bars of said movable lock bar sets are resiliently biased into said engagement with said fixed lock bars.

20. The enclosure of claim 1 wherein said one or more movable lock bar sets include rack gears that are driven by a gear on said lock bar retraction assembly.

21. The enclosure of claim 1 wherein said one or more movable lock bar sets include drive pins that are driven by a drive wheel on said lock bar retraction assembly.

22. The enclosure of claim 1 wherein said one or more movable lock bar sets include drive links that are linked to a drive crank on said lock bar retraction assembly.

23. The enclosure of claim 1 wherein said security drive mechanism comprises a security lock on said retraction assembly configured to receive a security key for actuating the retraction assembly.

24. A high-security enclosure, comprising:

a base;

a cover pivotally mounted to said base;

a lock system for locking said cover to said base;

said lock system including a base portion on said base and a cover portion on said cover;

said lock system base portion including one or more elongated fixed lock bars on an inside of said base, said one or more fixed lock bars each including one or more catch portions and one or more elongated stiffener portions stiffening one or more wall portions of said base;

said lock system cover portion including one or more movable lock bars on an inside front wall of said cover, said one or more movable lock bars being generally perpendicular to, and arranged to engage, said one or more fixed lock bar catch portions;

said lock system cover portion further including a lock bar retraction assembly coupled to said one or more movable lock bars for retracting said movable lock bar(s) out of engagement with said one or more fixed lock bars, said movable lock bars and said lock bar retraction assembly being oriented generally parallel to said cover front wall, and said lock bar retraction assembly being oriented generally perpendicular to said movable lock bars; and

a security drive mechanism coupled to said lock bar refraction assembly to drive said lock system, said security drive mechanism being substantially axially aligned with said lock bar retraction assembly.

25. A high-security enclosure, comprising:

a base;

a cover that is both pivotally and slidably mounted to said base;

a lock system for locking said cover to said base;

said lock system including a base portion on said base and a cover portion on said cover;

said lock system base portion including a pair of first and second fixed lock bars arranged in mutually parallel spaced relationship with each other;

said lock system cover portion including one or more sets of movable lock bars arranged in mutually parallel spaced relationship with each other;

each movable lock bar set including first and second movable lock bars that are generally perpendicular to, and arranged to respectively engage, said first and second fixed lock bars;

said lock system cover portion further including a lock bar retraction assembly coupled to said movable lock bar sets for refracting said movable lock bars out of engagement with said fixed lock bars;

a security drive mechanism coupled to said lock bar refraction assembly to drive said lock system;

said fixed lock bars each include one or more catch portions for engaging a movable lock bar of said one or more movable lock bar sets, and a stiffener portion for stiffening portions of said base on which said fixed lock bars are mounted;

said one or more catch portions and said stiffener portions being either integrally formed on a piece of bar stock, or being respectively provided by one or more catch fittings and a separate stiffener channel;

said movable lock bars being slidable within bracket assemblies mounted on said cover, said bracket assemblies being stiff relative to portions of said cover on which said bracket assemblies are mounted to provide improved security by resisting disengagement of said lock system base and cover portions due to deformation of said cover;

said cover being configured to enclose said base in a nested relationship and said base including one or more backplate flanges that enclose one or more portions of said cover when said cover encloses said base;

said lock bar retraction assembly including one or more lock bar engaging members operatively coupled to said one or more movable lock bar sets and one or or more actuators arranged to drive one or more said lock bar engaging members;

said one or more lock bar engaging members being selected from the group consisting of cams, gears, drive wheels and drive cranks;

said first and second lock bars of said one or more movable lock bar sets being biased into said engagement with said fixed lock bars; and

said security drive mechanism comprising a security lock on said retraction assembly configured to receive a security key for actuating said retraction assembly.

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